

Comprehensive Project Planning

# Designing to Achieve Sustainability

Springfield Developers Conference

October 27, 2010

# Opening Comments

- Innovate, Create, Grow ... Make it Happen!!!
- Sustainable Design
  - *What?*
  - *Why?*
  - *How?*
- Show Me!



*Green Roof – Queens Botanical Garden, NY*



# Presenters

Mike DeNamur, LEED® AP  
Vice President – Strategic Marketing & Sales  
Automated Logic Branch Operations  
29 North Plains Hwy.  
Wallingford, CT 06492  
203.284.0100  
[mike.denamur@automatedlogic.com](mailto:mike.denamur@automatedlogic.com)

Marc Sternick, AIA, LEED® AP  
Vice President, Senior Project Architect  
Dietz & Company Architects, Inc.  
17 Hampden Street  
Springfield, MA 01103  
413.733.6798  
[marks@dietzarch.com](mailto:marks@dietzarch.com)

Aris W. Stalis, ASLA, LEED® AP  
Landscape Architect  
Fuss & O'Neill  
56 Quarry Road  
Trumbull, CT 06611  
203.374.3748  
[astalis@fando.com](mailto:astalis@fando.com)

# What is happening

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*Why are we striving for sustainability?*

# Investment



*High Line – New York, NY*



*Green Roof – Meat Packing District, NY, NY*

# Value of investment?



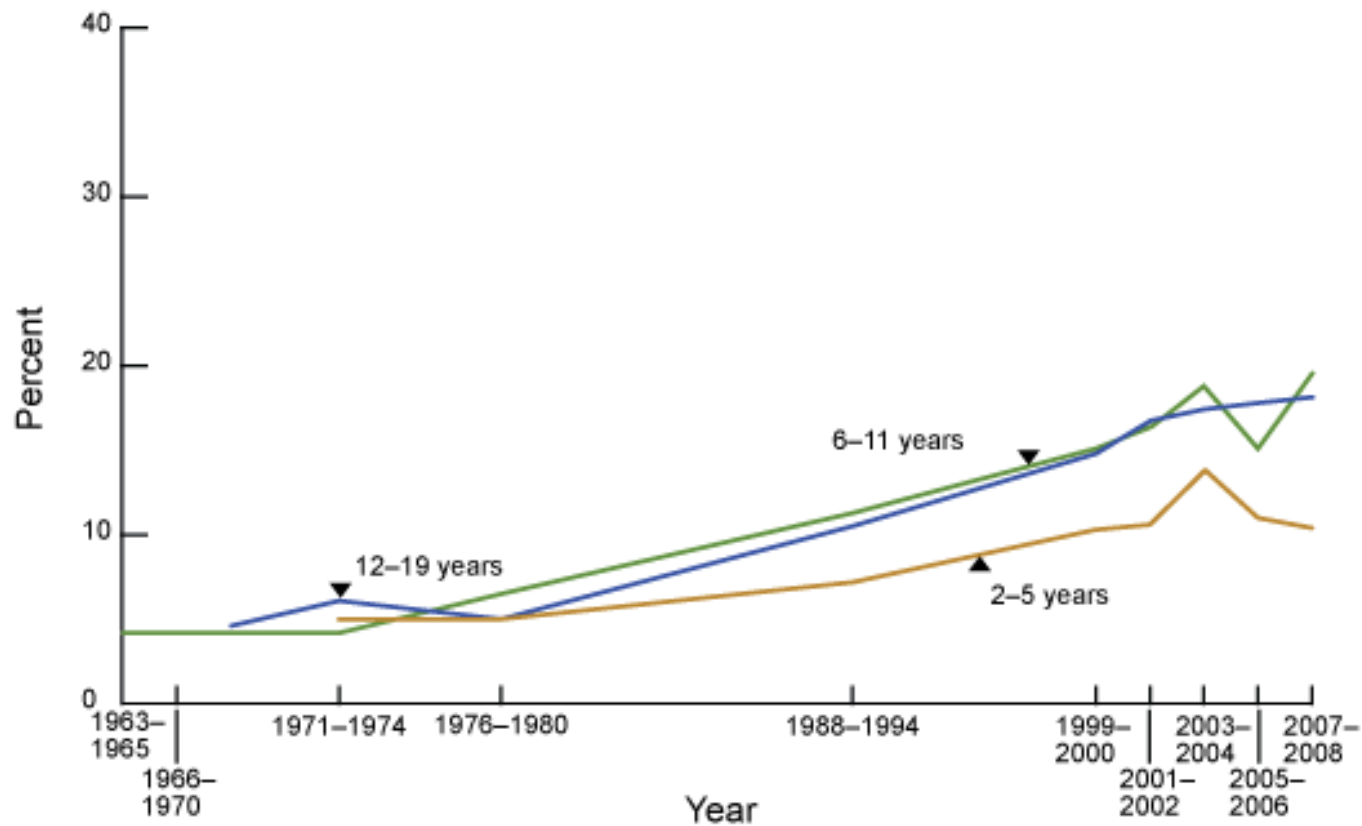
*High Line – New York, NY*



*Residential Deck, Connecticut*

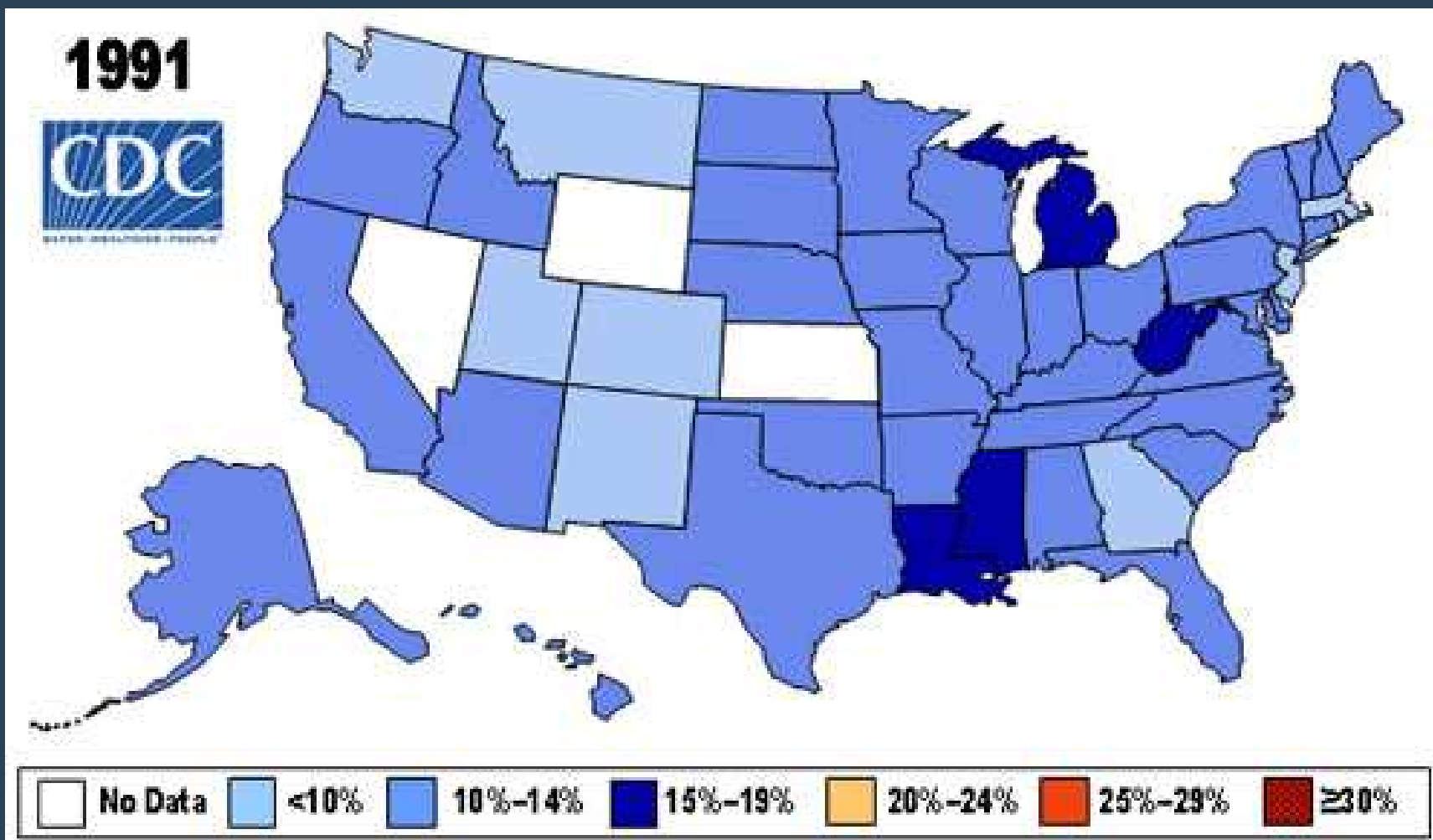
# What is happening.

**Figure 1. Trends in obesity among children and adolescents: United States, 1963–2008**



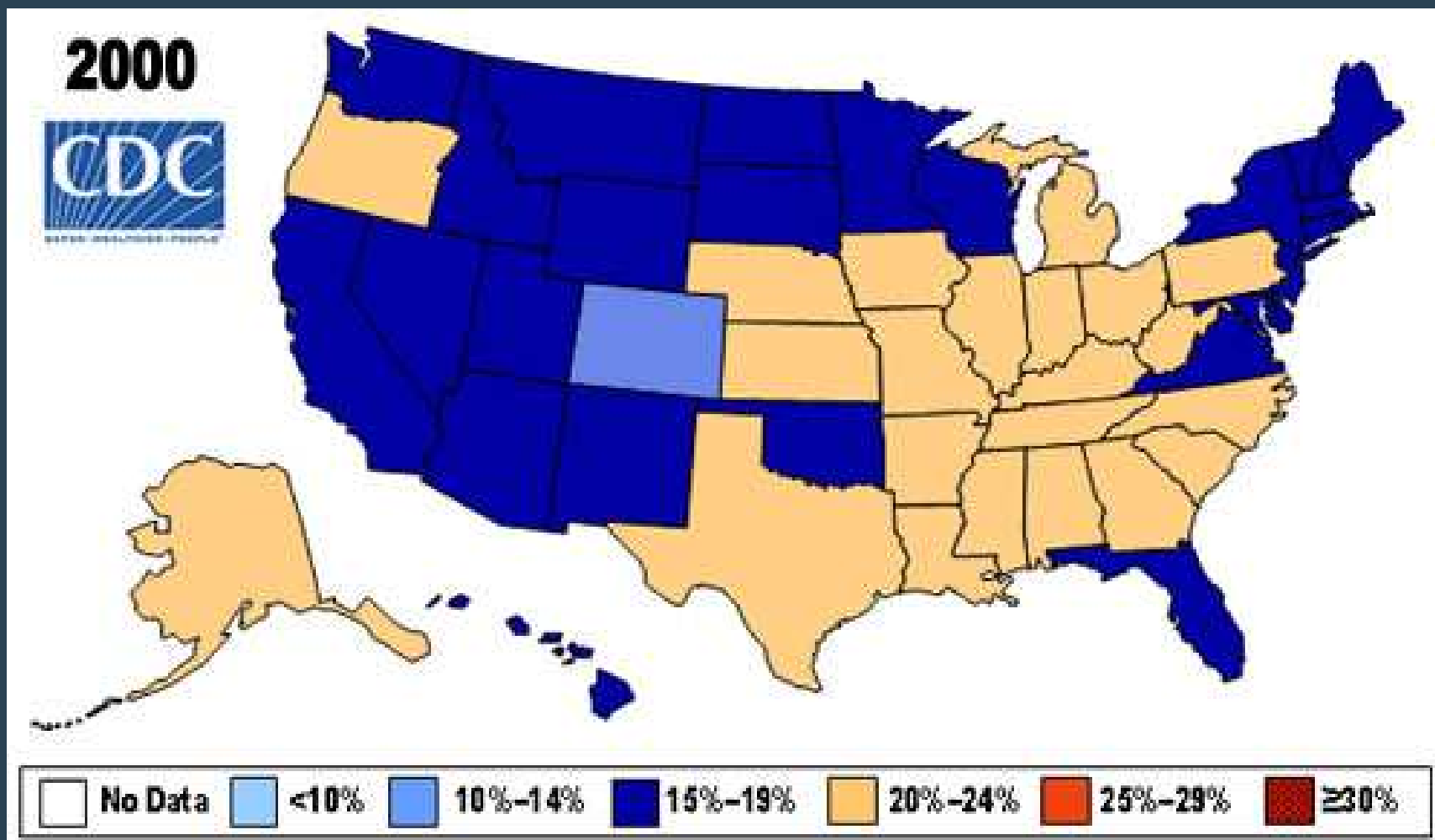
NOTE: Obesity is defined as body mass index (BMI) greater than or equal to sex- and age-specific 95th percentile from the 2000 CDC Growth Charts.  
SOURCES: CDC/NCHS, National Health Examination Surveys II (ages 6–11), III (ages 12–17), and National Health and Nutrition Examination Surveys (NHANES) I–III, and NHANES 1999–2000, 2001–2002, 2003–2004, 2005–2006, and 2007–2008.

# Obesity Trend



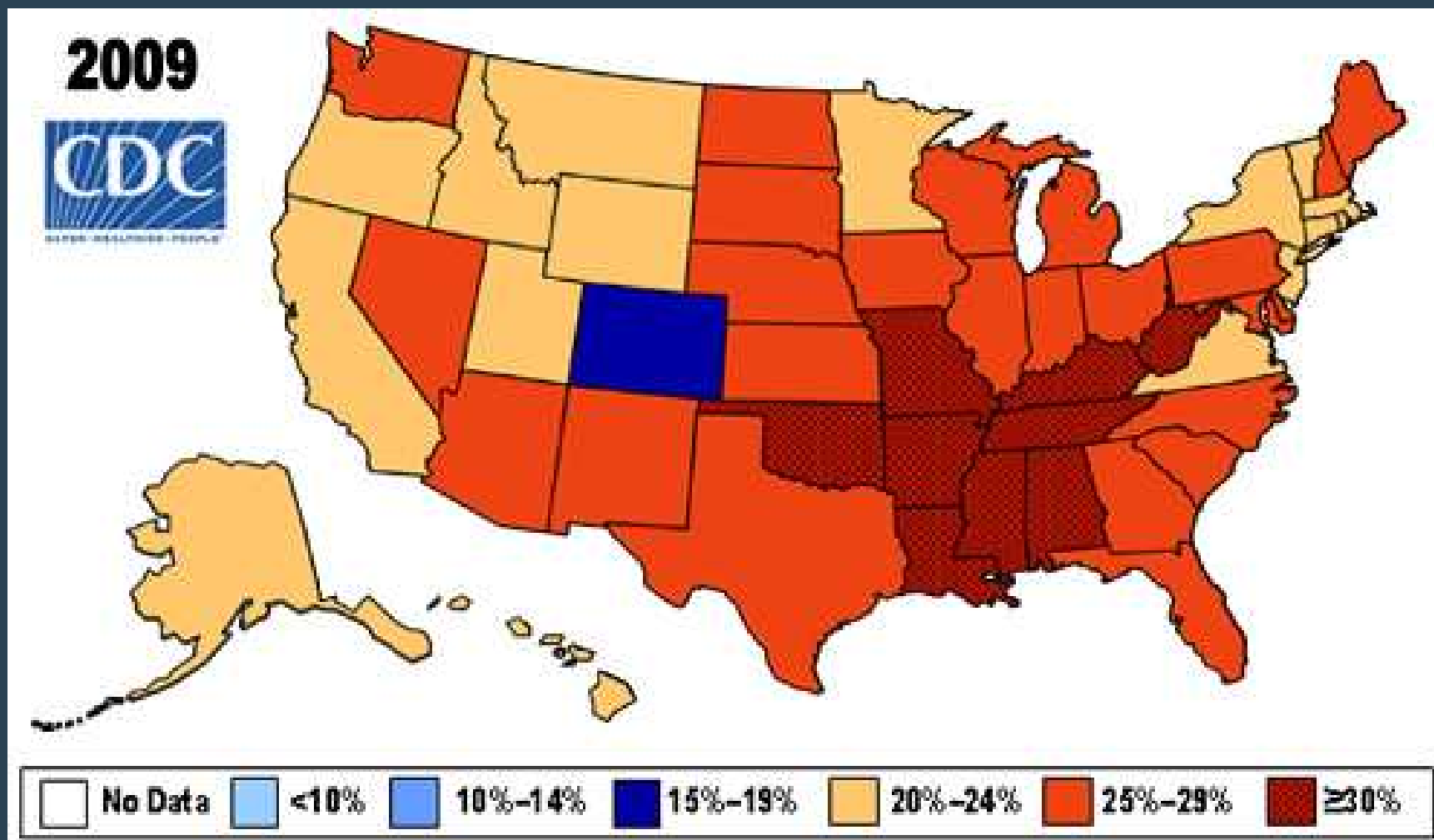
*in US Adults*

# Obesity Trend



*in US Adults*

# Obesity Trends

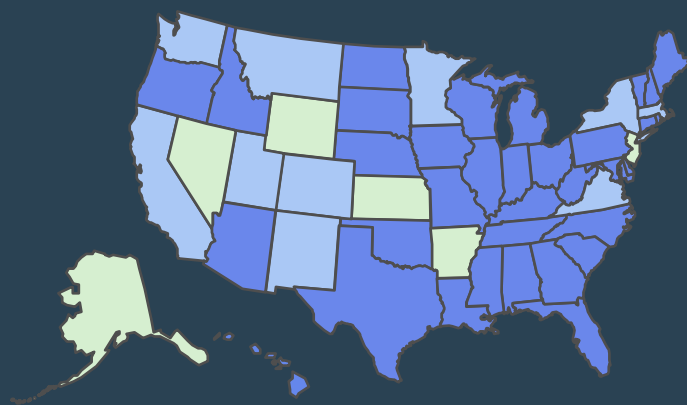


*in US Adults*

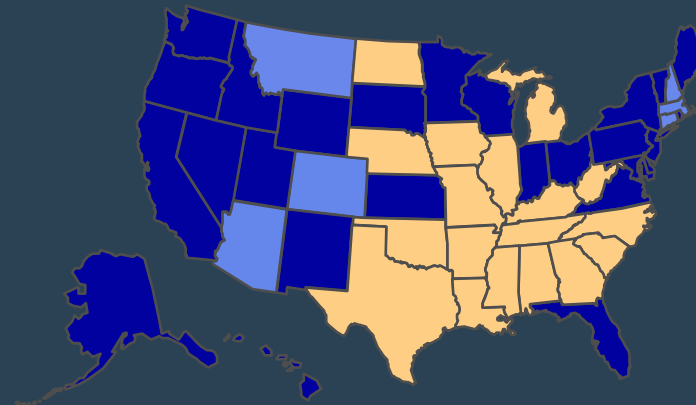
# Obesity Trends\* Among U.S. Adults

BRFSS, 1990, 1999, 2009

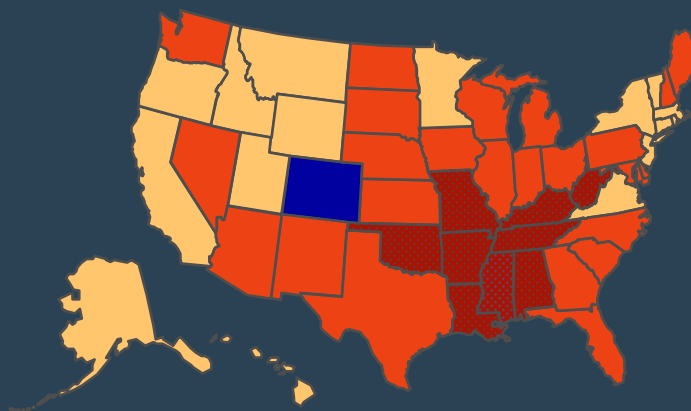
(\*BMI  $\geq 30$ , or about 30 lbs. overweight for 5'4" person)



1990



1999



2009

No Data   <10%   10%–14%   15%–19%   20%–24%   25%–29%    $\geq 30\%$



# The Research

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*Why are we striving for sustainability?*

# Research

## *Contact with Nature Benefits Children.*

- Improved Health & Well Being
- Psychological Benefits
- Reducing the impact of Attention Deficit Disorder
- Developing the capacities for creativity, problem-solving, and emotional and intellectual development
- Improved Cognitive & Social Skills
- School Achievement Is Enhanced When Curricula Are Environment Based



# Outdoor Education Impact

- 27% increase in measured mastery of science concepts; enhanced cooperation and conflict resolution skills; gains in self-esteem; gains in positive environmental behavior; and gains in problem-solving, motivation to learn, and classroom behavior.

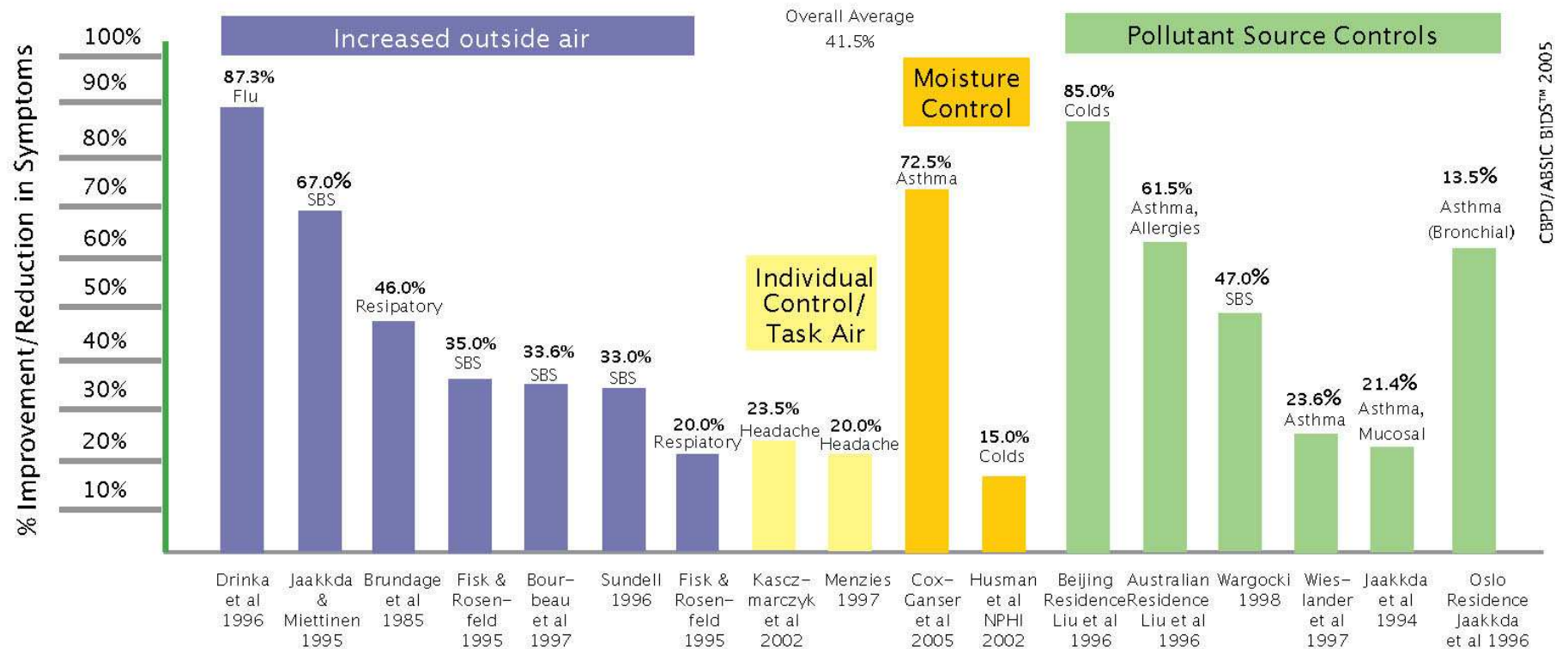


(Original research)

"Effects of Outdoor Education  
Programs for Children in California."  
American Institutes for  
Research: Palo Alto, CA: 2005.

# Research

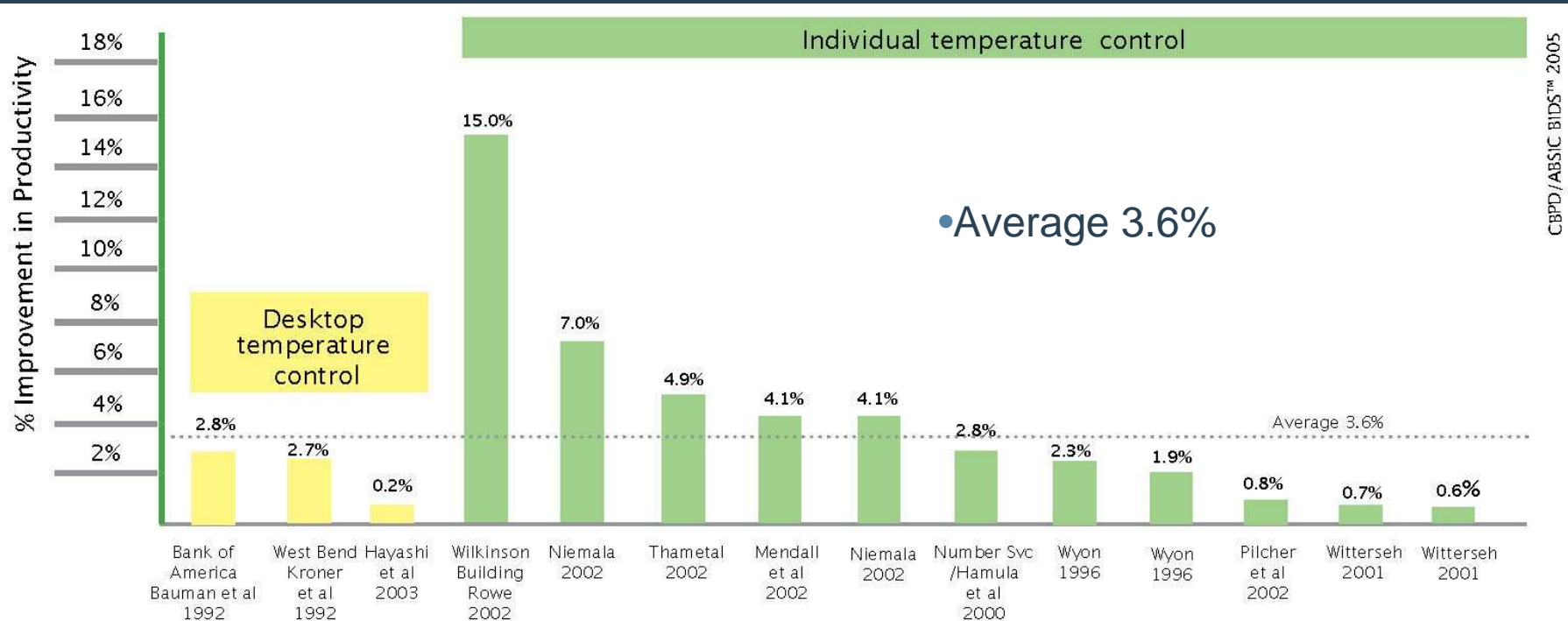
- Health Gains from Improved Indoor Air Quality



• Overall Average 41.5%%

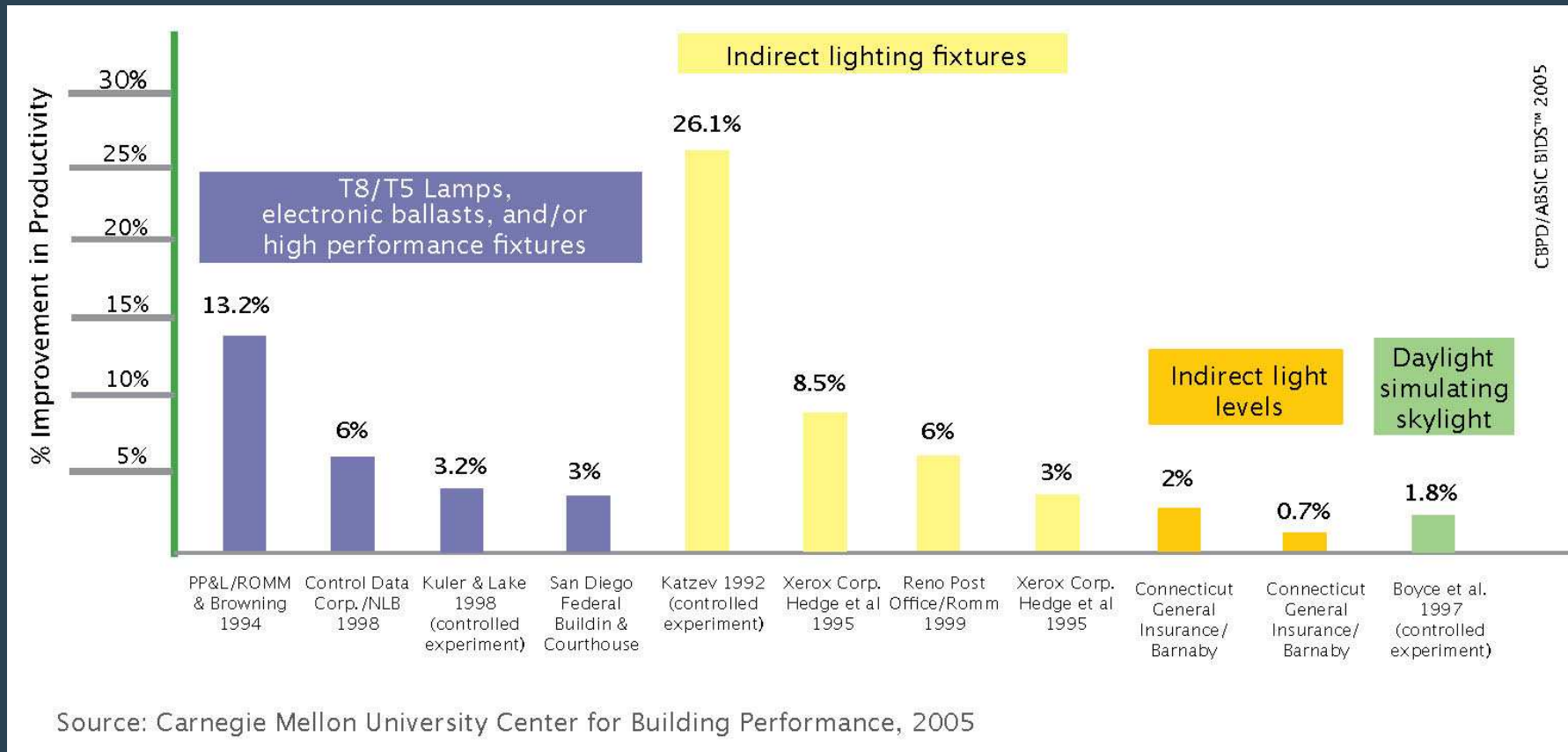
# Research

- Productivity Gains from Improved Temp Controls



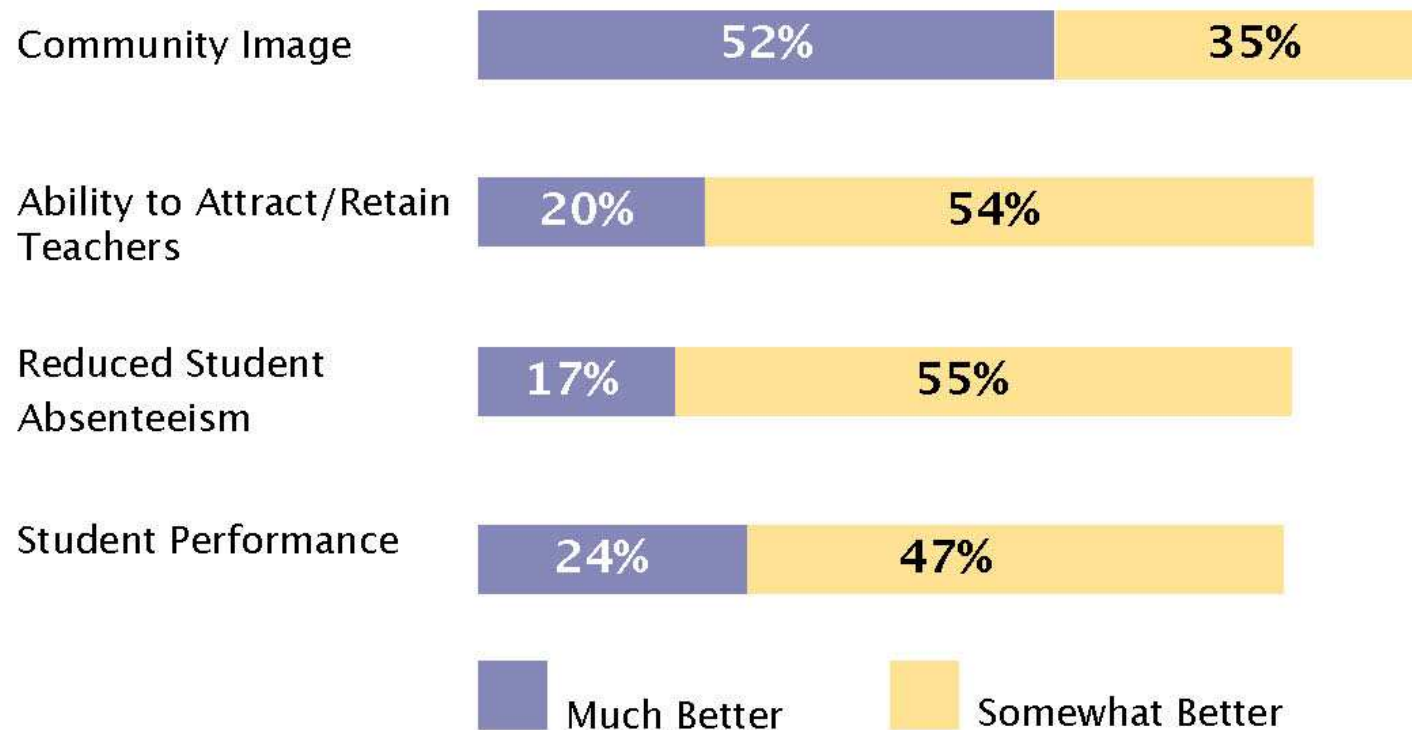
# Research

- Productivity Gains from High Performance Lighting Systems



# Research

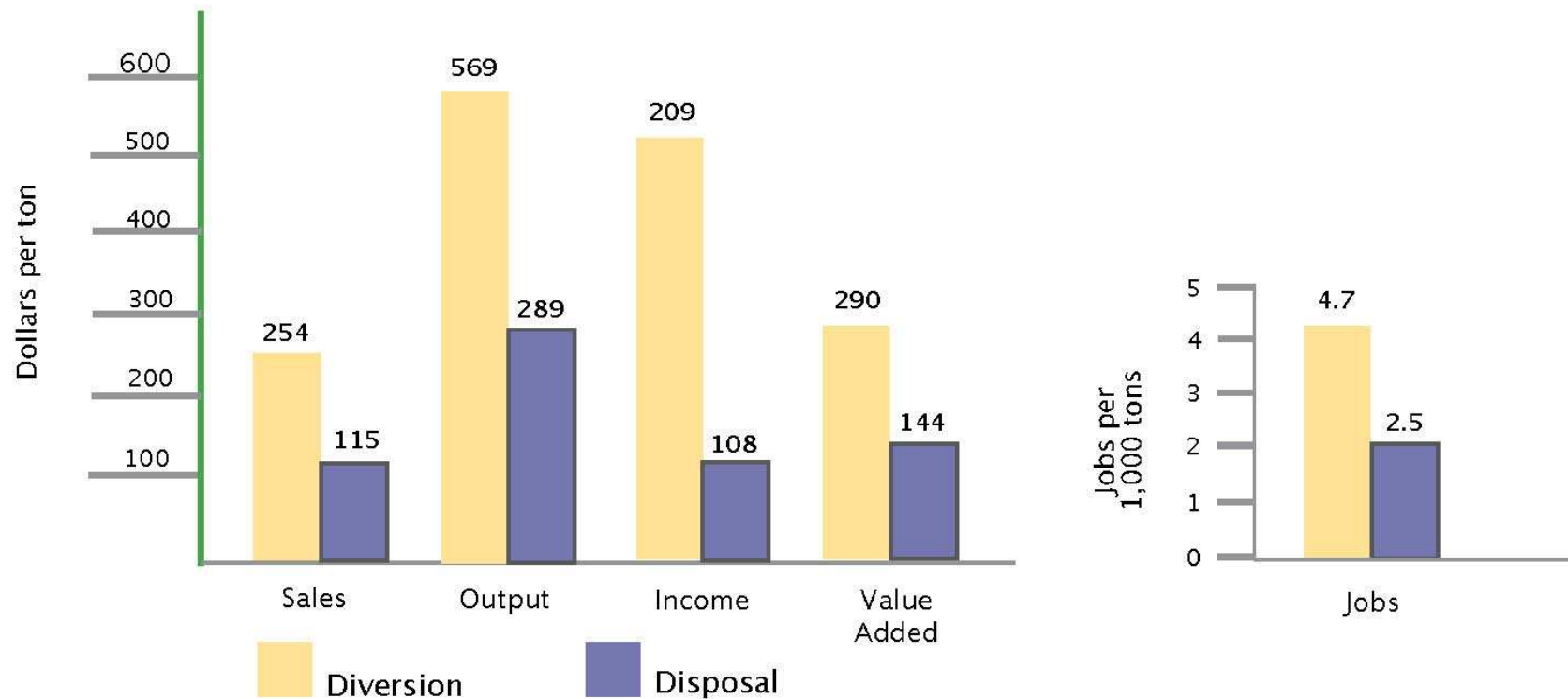
- Executive Views of Green School Performance Compared with Conventional Schools



Source: Turner Construction 2005 Survey of Green Buildings

# Research

- Job Impacts of Waste Diversion vs. Disposal



Source: Goldman and Ogishi, UC Berkeley, 2001

# Research

- Executives' View of Green Building Benefits



Source: Turner Construction 2005 Survey of Green Buildings

- Conclusions for Green Schools

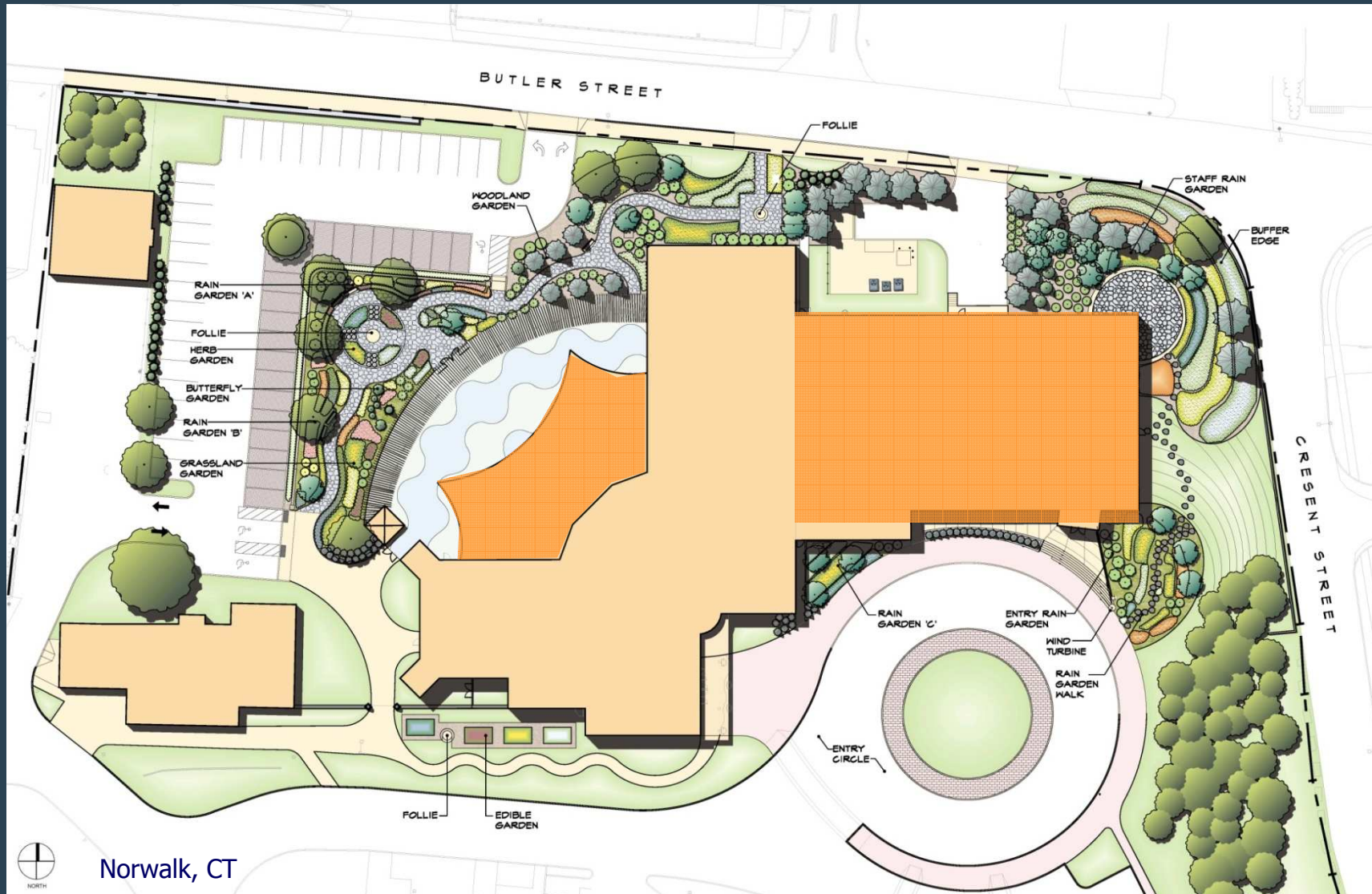
Financial Benefits of Green Schools (\$/ft <sup>2</sup> )	
Energy	\$9
Emissions	\$1
Water and Wastewater	\$1
Increased Earnings	\$49
Asthma Reduction	\$3
Cold and Flu Reduction	\$5
Teacher Retention	\$4
Employment Impact	\$2
TOTAL	\$74
COST OF GREENING	(\$3)
NET FINANCIAL BENEFITS	\$71

"Greening America's Schools  
Costs and Benefits"  
Author: Gregory Kats  
October 2006

# The Approach

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# Stepping Stones Museum for Children



Norwalk, CT

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# Stepping Stones Museum for Children



- Project Culture from Beginning - **HOW**
- Considering broad impacts of our work - **WHY**



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# Stepping Stones Museum for Children



Education for Owner / Visitor

- Storm water Infiltration
- Children's garden space



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# Stepping Stones Museum for Children



- Improved Activity Space
- Additional programming area
- Increase opportunity for fundraising



Norwalk, CT

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# Stepping Stones Museum for Children



- Improved water quality Norwalk River
- Public Access
- Community Benefits

Norwalk, CT



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# Stepping Stones Museum for Children



Stepping Stones Museum for Children

- Education



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# YWCA – Phase II

- 32,000 SF Two-Story Building
- Awaiting LEED Gold Certification
- Energy Efficient Construction Methods
- High Efficiency HVAC Equipment
- Building/Finish Materials w/ High Recycled Content
- Large Roof Mounted Photovoltaic Solar Array



# Easthampton Savings Bank

- Building Reuse
- Tight, Well-Insulated Shell
- Original Building Materials Salvaged
- Fiber Cement Siding
- Natural Linoleum Flooring
- Low or No V.O.C Interior Finishes



# Village at Hospital Hill

- Super insulated Shell
- Maximized Daylighting
- EnergyStar Appliances and Light Fixtures
- Fiber Cement Siding
- High Efficiency Gas Heat and Hot Water
- Low or No V.O.C Interior Finishes
- Roof-mounted Photovoltaic Panels
- Energy Rating averaged HERS-40



# Caring Health Center

- Renovations to Three Existing Historic Buildings in Springfield
- New Building will include:
  - Outpatient Support Areas
  - Primary Care Outpatient Centers
  - Outpatient Diagnostic Facilities
  - Laboratory Suite
  - Mental Health Counseling



- Upgrades to Existing Buildings Will Include:
  - High Efficiency Windows
  - High Efficiency Mechanical Systems
  - No V.O.C Interior Finishes
  - High Efficiency Ventilation System



# New Green Office Building

- Super insulated Shell
- High Efficiency Windows
- High Efficiency Mechanical Systems
- No or Low V.O.C Interior Finishes
- Maximized Daylighting
- State of the Art Lighting Controls



# Framework

- Determine the Owner's Commitment to Sustainability
  - *If commitment already exists, move to Understanding Motivation and Goal Setting*
  - *If not, look at Sustainability vs. what Owner considers important*
  - *Look for teaching opportunities*
  - *Be prepared to prove points on sustainability*
- Motivation: People, Planet or Profit
  - *No Judgments*
  - *Any one of these motivators is sufficient*
- Goal Setting
  - *Financial*
  - *Measurable Results (LEED, HERS or other measurement systems)*
- Integrated Design Process
  - *All decision makers are on the team from the beginning*
  - *Collaboration / Engagement*
  - *Methods of Project Delivery are changing (Bidding – CM at Risk)*

# New Green Office Building



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# The Process

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# Process

## Create a Baseline for Energy Modeling

- Current Energy Use

*Total Utility (Electric and Gas) Bills for one year on the existing office building was approximately \$80,000 (\$2.72/sf). The code minimum building at the same utility rate would be estimated at \$102,000. The existing office building appears to be 13% less costly than the code base building (per sf).*

- Energy Goals for New Building

*Assuming a base case of \$102,000 per year in electric and gas usage for the new building, the following upgrades in energy-related systems will allow for a greatly reduced electrical load:*

*high efficiency lighting systems, high efficiency mechanical systems, controls and equipment, shading windows from direct sun, light shelves on the south side to providing maximum daylighting into open work areas, high efficiency windows, operable windows for passive cooling, photovoltaic panels to produce electricity, and a well sealed and insulated building envelope.*

*Providing all of these strategies can result in a reduction of energy use of 25% - 50%. For this building, with a base power cost of \$102,000 per year, this could result in savings of between \$510,000 & \$1,020,000 over a 20 year investment period, assuming utility rates will not rise.*

*However, in order to achieve these kinds of savings, a commitment to prioritize energy saving strategies must be made early on.*

# Process

## Provide an Initial Analysis of Energy Options

- Mechanical System Options
- Energy Modeling will be provided for three different mechanical systems
  - *Option 1, a ground-source (geothermal) heat pump system is the most efficient and also the system with the highest up-front cost.*
  - *Option 2 is an air-based heat pump system, with a moderate cost.*
  - *Option 3 consists of a chiller and a boiler with fan coil units above the ceiling. Option 3 is the lowest cost of the three efficient systems being modeled for this building.*
  - *For comparison reasons, all three options will be compared against a baseline mechanical system option that meets the code minimum for this building.*
  - *All three options will be analyzed for cost savings over a 20 year period.*

# Process

## Initial Analysis of Energy Options

- Renewable Energy System Options

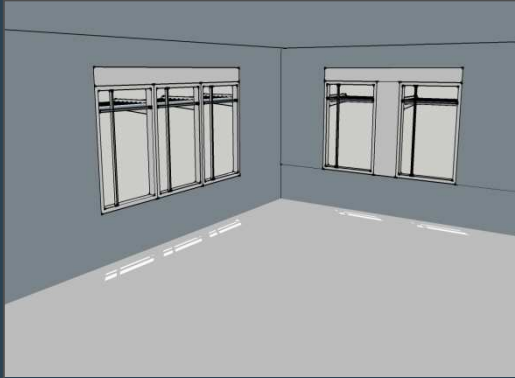
- Solar (Photovoltaic) Panels

- *This site allows for several options for PV. The quantity, locations, etc can be optimized to fit ESB's budget and ROI.*
- *Currently, PV systems are being installed at \$6-\$7 a watt. Being conservative for this first pass let's assume \$7. The following is a quick financial analysis.*
- *Option 1 initial cost - \$130,000.*
- *Option 2 initial cost - \$343,000.*
- *Option 3 Initial cost - \$123,000.*
- *Currently there is a 30% federal tax credit.*
- *Also, the owner of a PV system can sell Solar Renewable Energy Credits (SRECs) on an Auction market. Last month in MA they sold for \$500/MWHR and they are guaranteed by the state to sell for \$300/MWHR for 15yrs. Assuming a min SREC price of \$300/MWHR):*
- *Option 1 – 22,000kwhrs or \$6,600 per year.*
- *Option 2 - 58,000kwhrs or \$17,400 per year.*
- *Option 3 – 20,800kwhrs or \$6,240 per year.*
- *Also, there is depreciation (MACRS) of equipment that can help reduce tax burden and decrease the payback period.*
- *Given all of this we are seeing payback periods in MA (using the most conservative assumptions) around 8 years.*

# Process

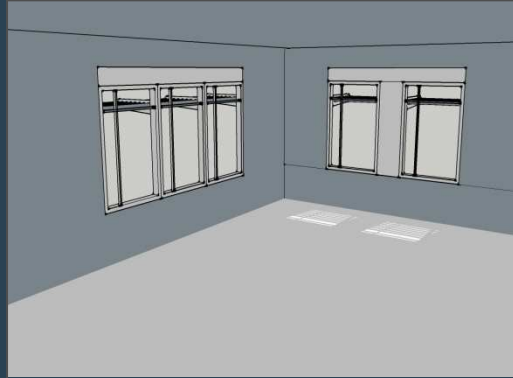
- Initial Analysis of Energy Options
- Renewable Energy System Options
- Wind
  - *Although vertical axis wind turbines are now being produced locally, initial research has uncovered information that a building-mounted wind turbine, in this location would produce less-than-optimal ROI as well as potential disturbances for the building occupants. Additional research will be provided.*
- Sustainability Features to be Analyzed and Reviewed with the Owner
  - *Developing the Site Sustainably*
  - *Maximizing Water Efficiency*
  - *Optimizing Energy Performance and Reducing Greenhouse Gas Emissions*
  - *Use of Sustainable Materials and Resources*
  - *Improving Indoor Environmental Quality*

## INTERIOR SOLAR STUDY SOUTH CORNER

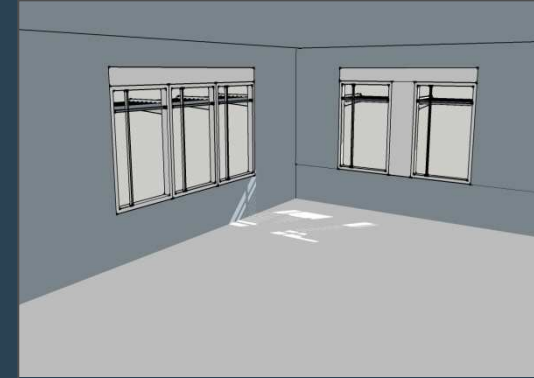


SUMMER 06.21

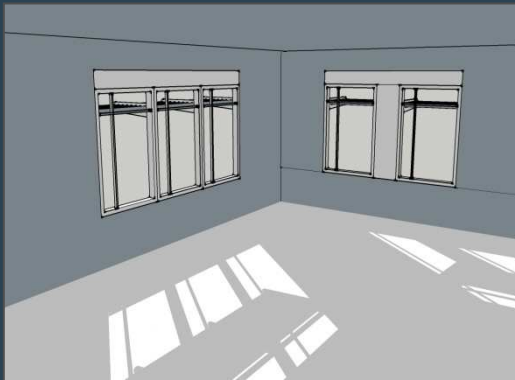
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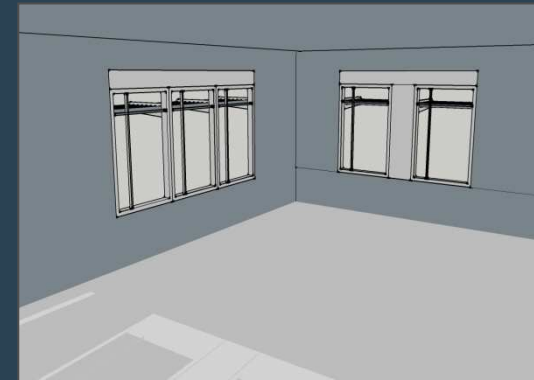
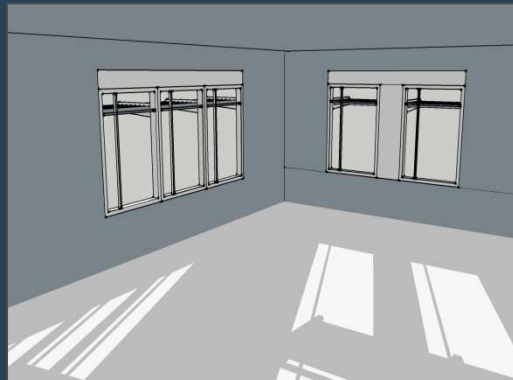
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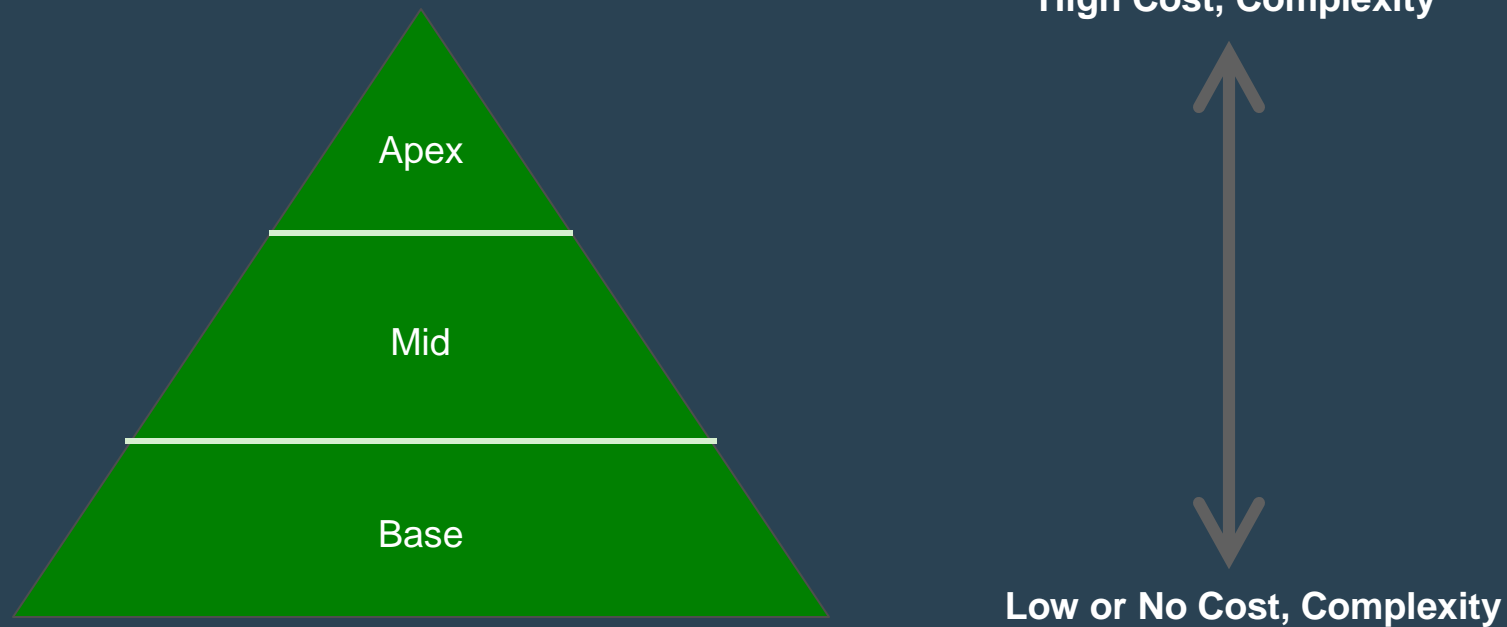
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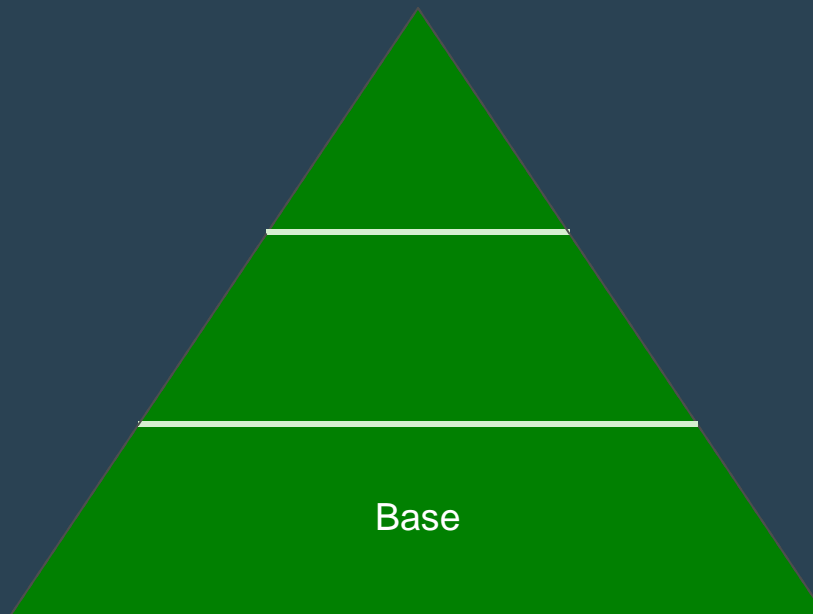
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# Sustainable Strategies Pyramid



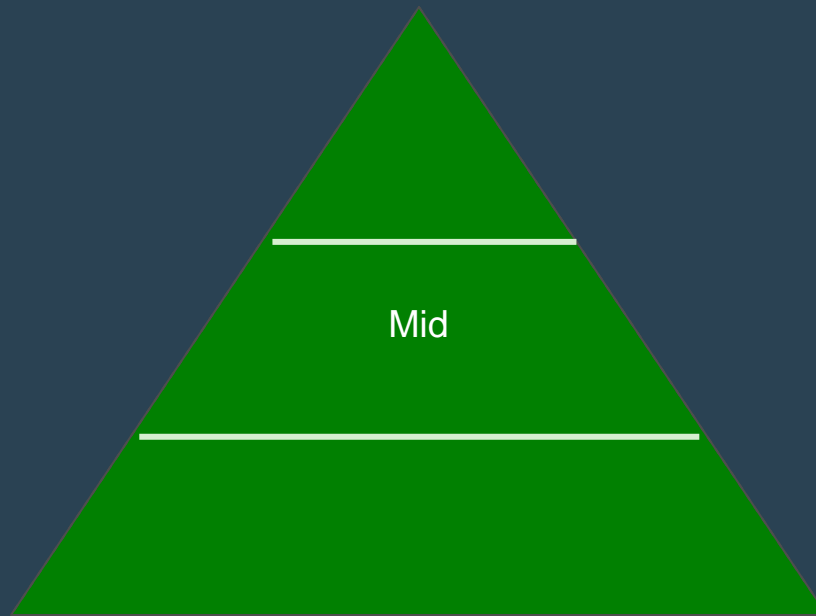
# Sustainable Strategies Pyramid



Low or No Cost, Complexity

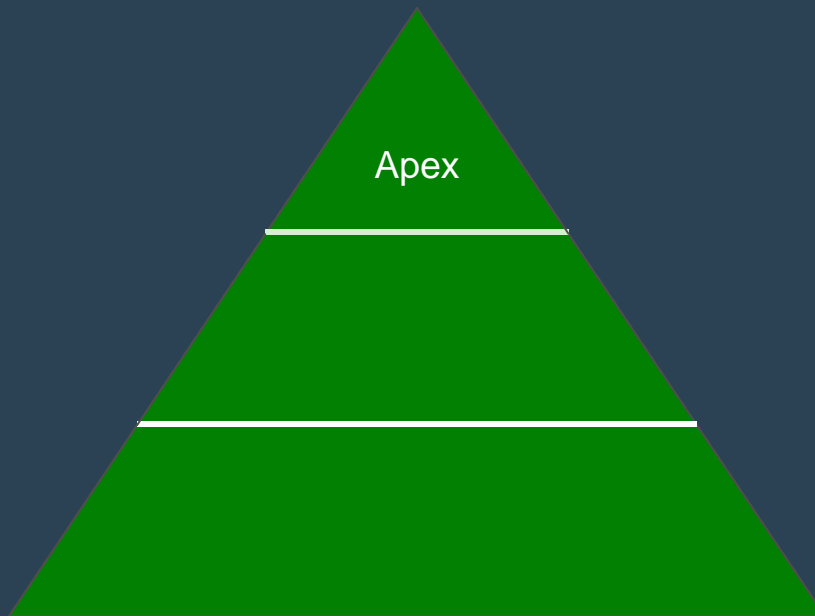
Integrated Design Process  
Building Site, Orientation  
Passive Solar Design  
Natural Ventilation  
Energy Efficient Construction  
Advanced Framing  
Construction Waste Recycling  
Minimize Impervious Surfaces  
Minimize Site Disturbance  
Use Indigenous Plantings  
Low-Flow Plumbing Fixtures

# Sustainable Strategies Pyramid



Active Conservation Measures  
(Smart Controls, Sensors)  
Super-Insulation  
Heat Recovery Ventilation  
Solar Water Heating  
High-Performance Glazing  
Daylighting  
Recycled Materials  
Graywater Use  
Rainwater Collection for Irrigation  
Building Commissioning  
Whole Building Energy Modeling

# Sustainable Strategies Pyramid



Building Integrated PV's  
Wind Turbines  
Fuel Cells  
Geothermal Heating and Cooling

# Discussion



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